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GB 0862704 A EP 0269475 A EP 0266052 A
EP 0029671 A US 4271453 A

(58) Field of Search
UK CL (Edition M) F3A
INT CL^5 F42B, F42C

(54) **Igniting device for a gas generator**

(57) An electrical igniter for a gas generating device for a vehicle air bag or belt tensioner comprises contact pins (8) connected by an igniting element (7). The pins (8) pass through a bore (12a) of a galvanically conductive ring (12) having a defined spacing (ê) from contact pins (8) and forming a reliable voltage surge protection with the earth (E). The igniting element (7), constructed as a glow wire, is located in a first detonator layer (5), which is pressed together with a second detonator layer (6). The second layer (6) is less highly explosive than the first layer (5) and has a pulse-reducing effect on the detonating pressure surge for expanding the air bag or for actuating the plunger in the belt tensioning means.

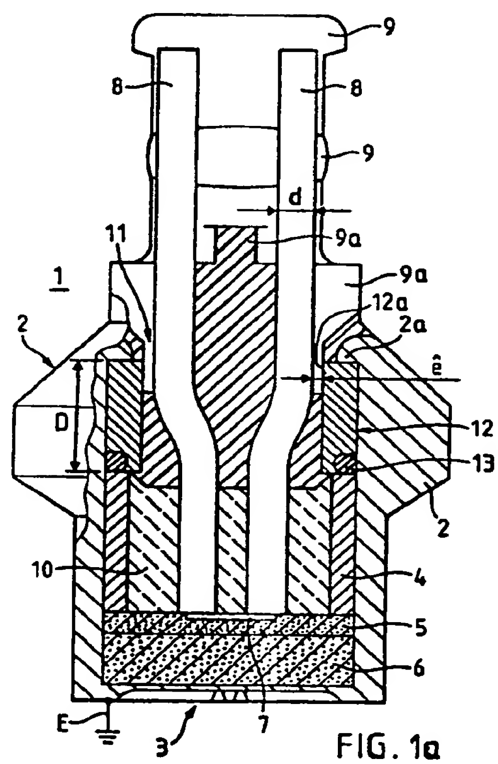

FIG. 1a

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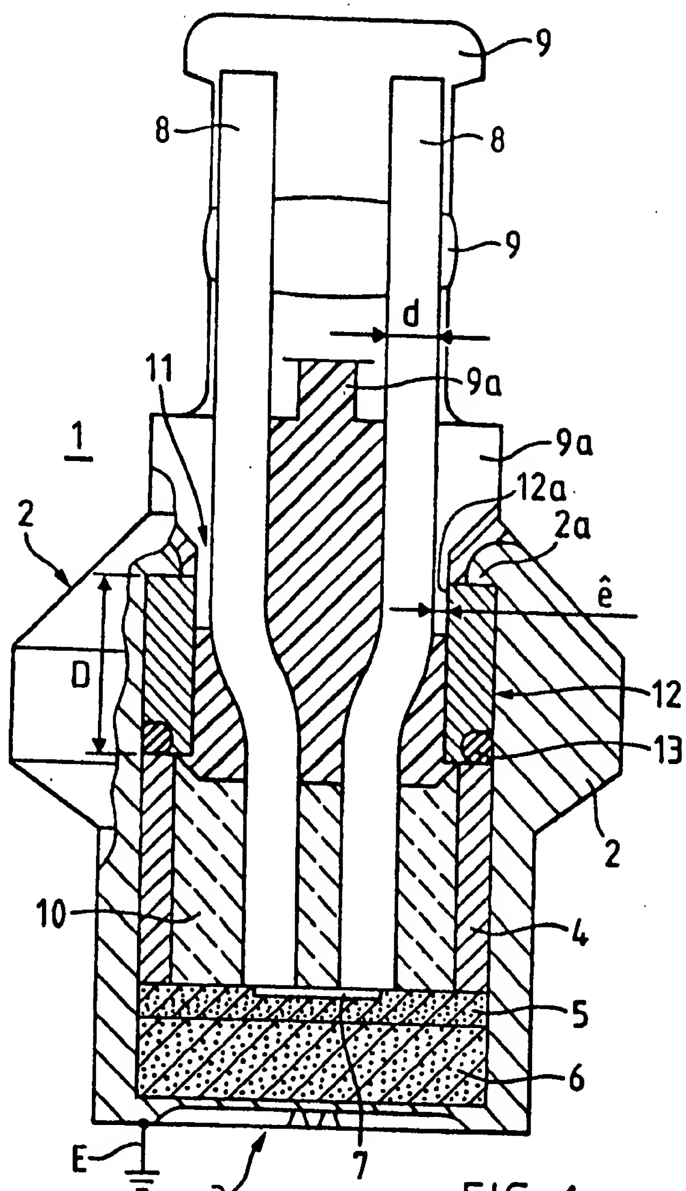

FIG. 1a

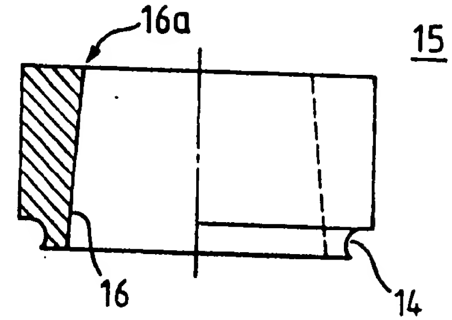

FIG. 2

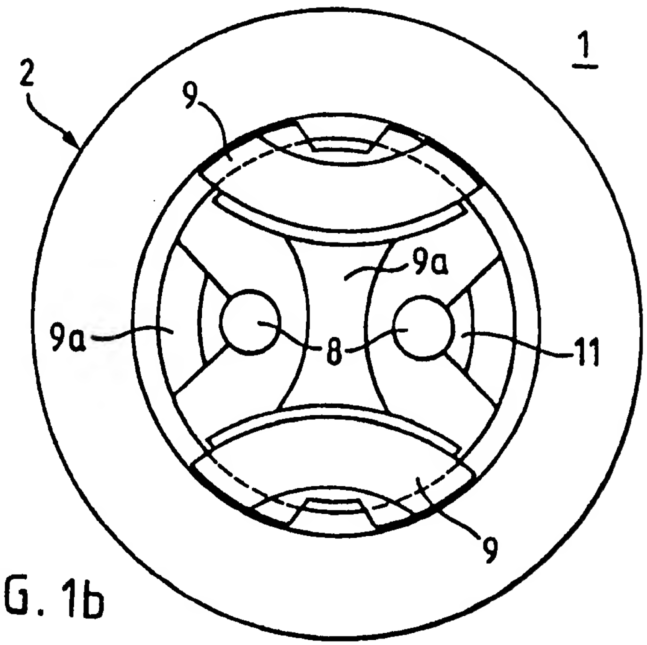

FIG. 1b

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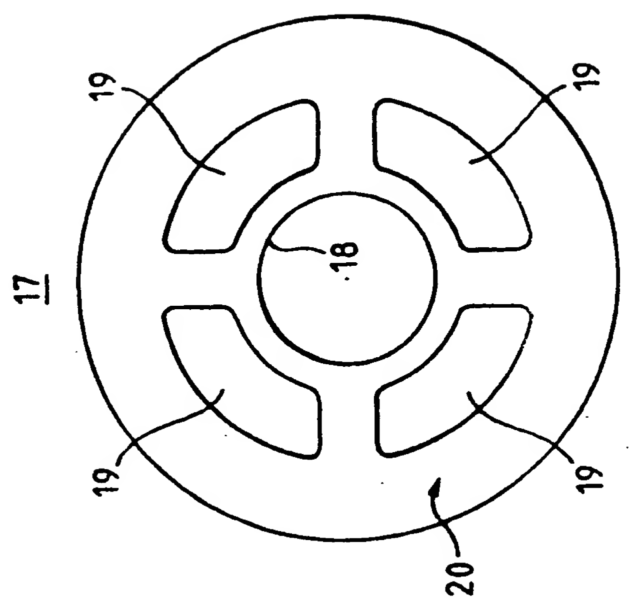

FIG. 4

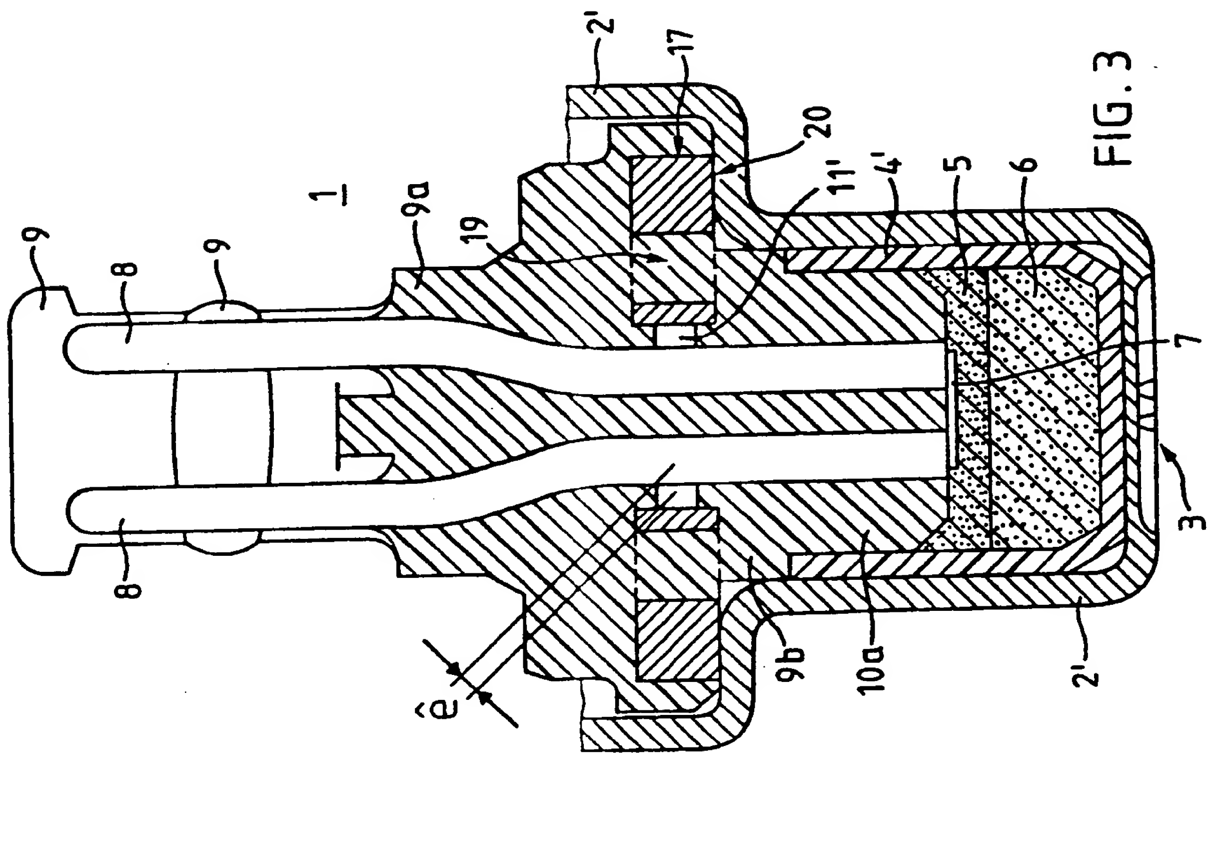

FIG. 3

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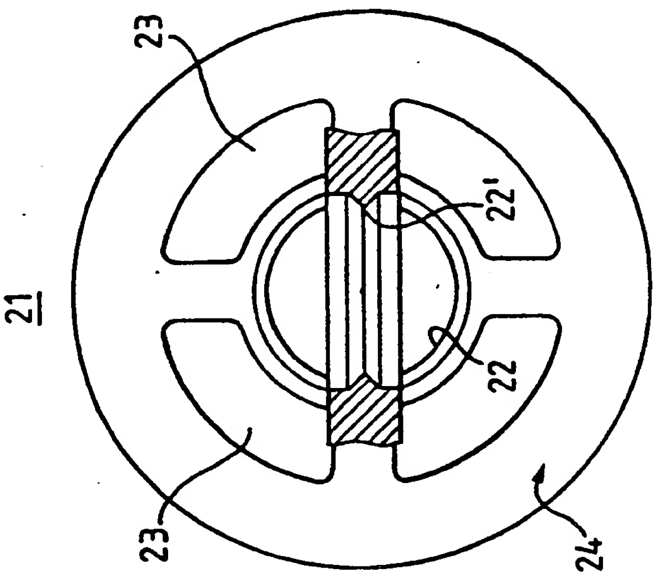

FIG. 6

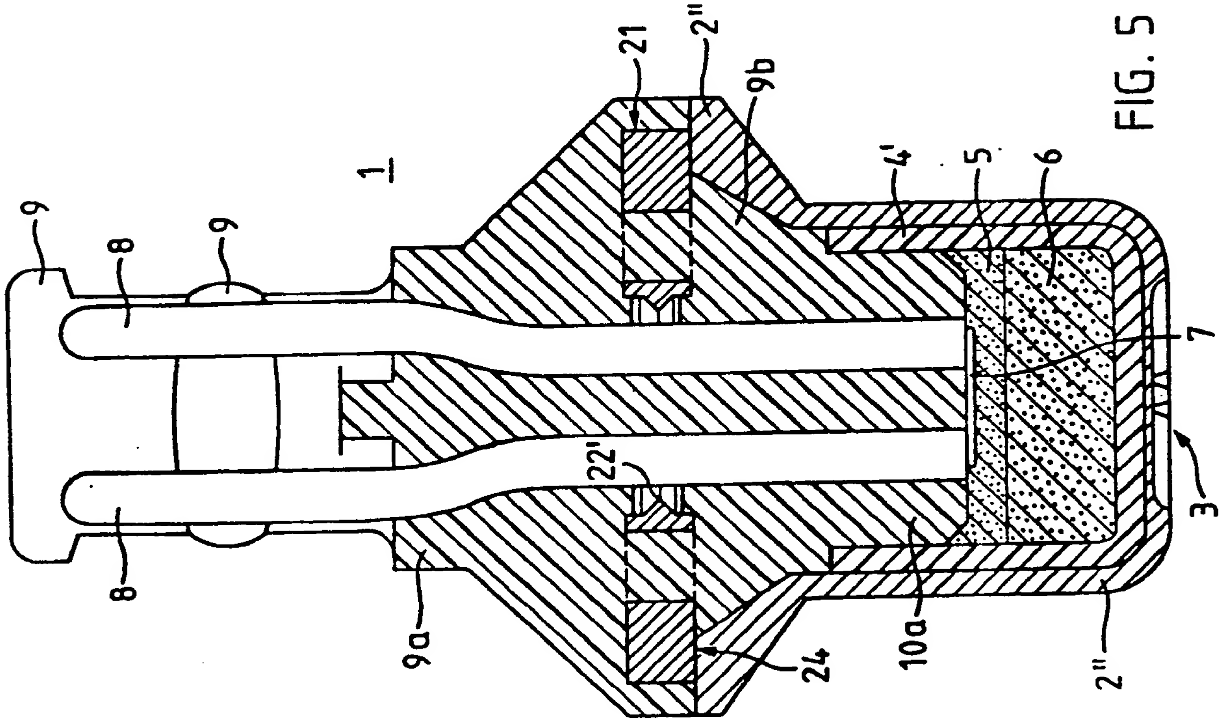

FIG. 5

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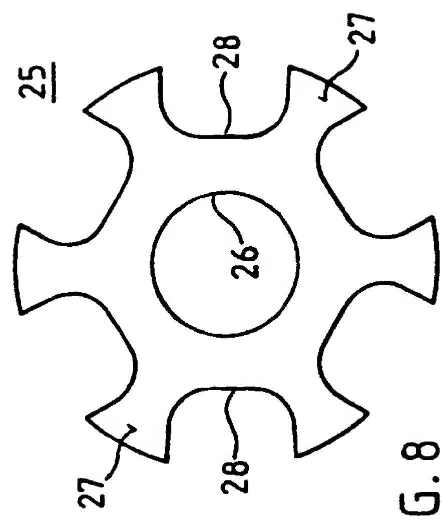

FIG. 8

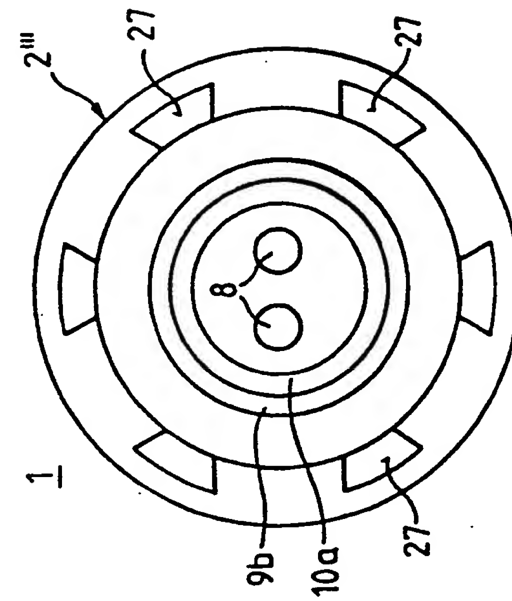

FIG. 9

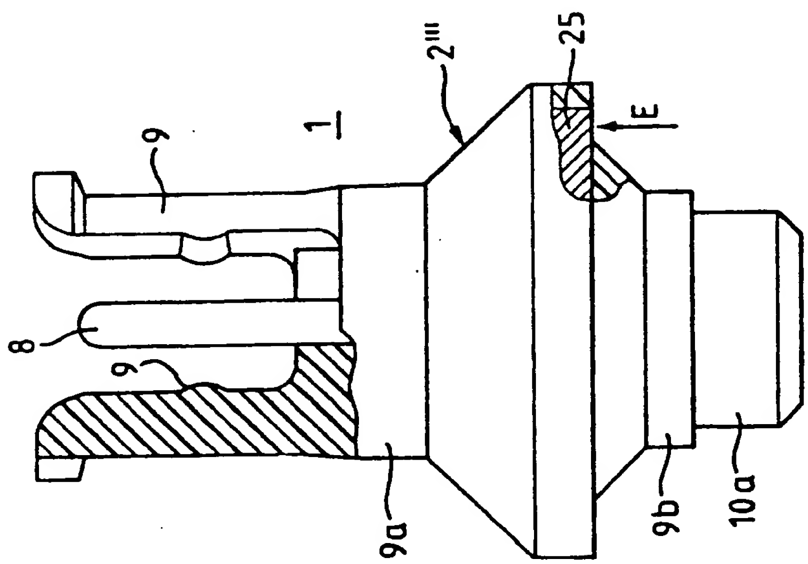

FIG. 7

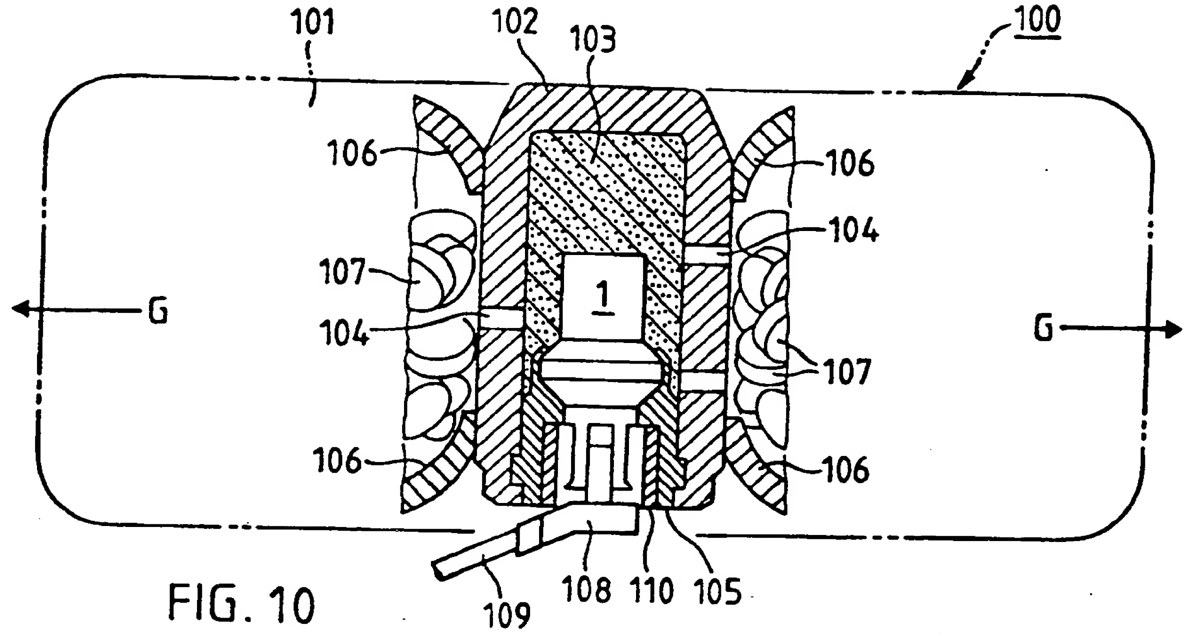

FIG. 10

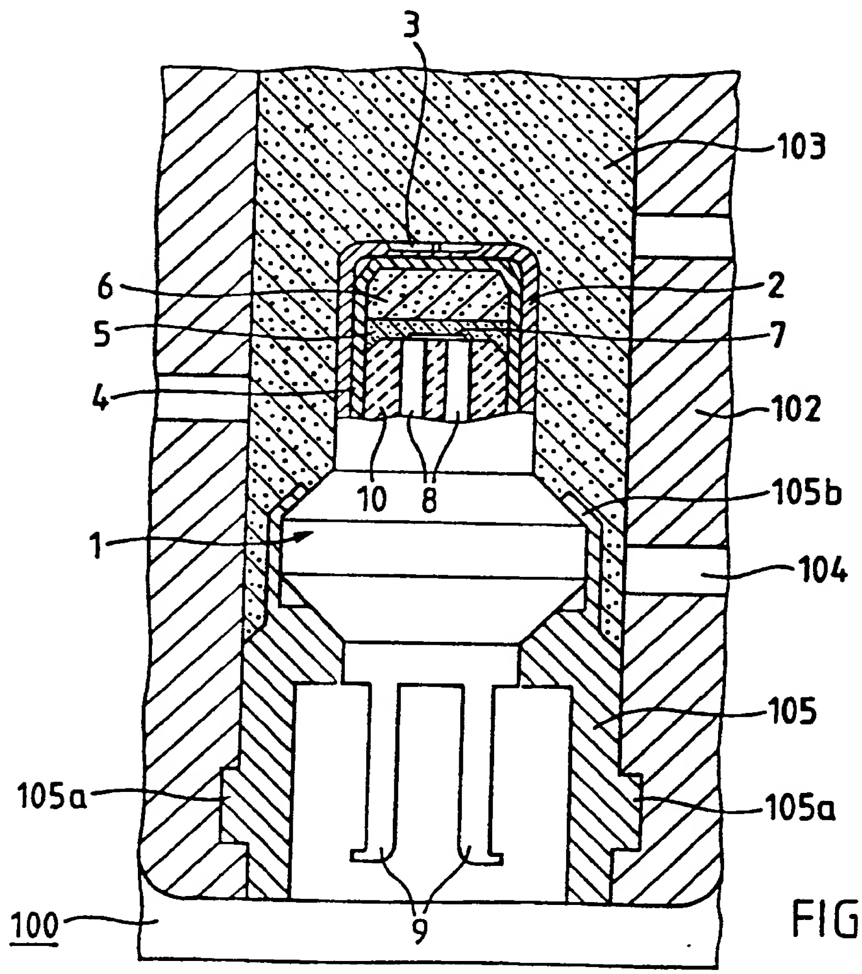

FIG. 11

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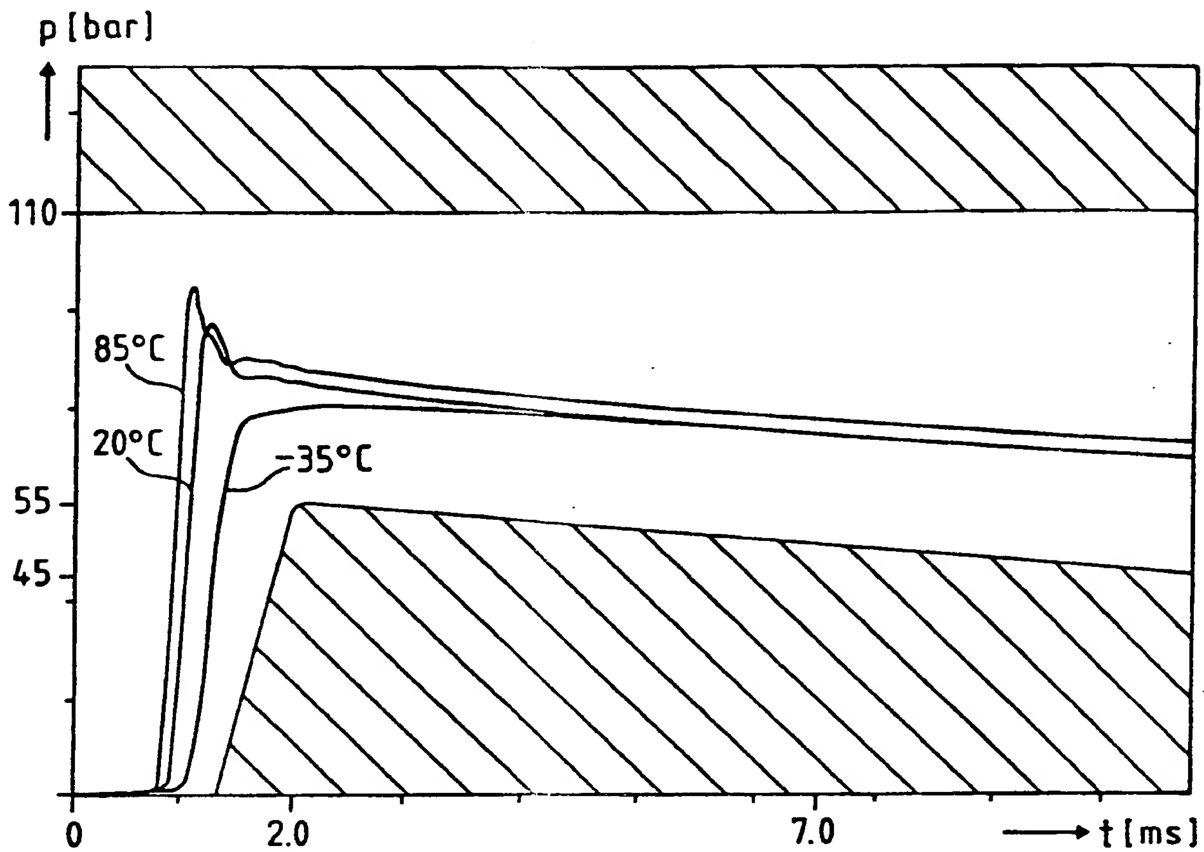

FIG. 12

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Gas Generator Igniting Capsule

The present invention relates to a gas generator igniting capsule having an electrical igniter and comprising a detonator, the electrical igniter being provided with a contact bridge having a defined electrical resistance, and at least one contact pin being attached to the contact bridge by means of a plug-type connection.

Electrical/pyrotechnic igniters in gas generators for impact protection systems (air bags and belt tensioning means) of the said type are known (inter alia from DE-C1-41 02 275).

As electronic igniting and monitoring apparatus in vehicle technology has spread, but in particular as a result of the increasing use of mobile radio equipment, the risk of momentary voltage surges which can activate an unprotected gas generator has risen. For this reason, special measures are necessary so that any uncontrolled peak voltage occurring in the vehicle electrical system does not bring about triggering of the air bag.

DE-A1-34 15 625 has already disclosed a high-tension igniter with a predetermined spark gap. In this case, circular and linear cutouts are provided in a metal layer and are connected to hollow pieces placed on in planar manner, and are intended to serve on the one hand as voltage surge diverters and on the other hand as ignition bridges. The whole thing is joined together by means of insulating rings and melt-type adhesives.

This construction requires the use of complicated photoetching processes or expensive laser cutting equipment to produce the required gap-shaped cutouts. Moreover, there is a risk of high electrostatic charges cutting through the insulating adhesive provided and involuntarily igniting the adjacent igniting composition, which comprises highly explosive detonator.

Additionally, US-PS-5,109,772 discloses the fact that boron potassium nitrate ($BKNO_3$) is a rapid ignition means for pyrotechnic fuel and as such is used for the propagation of the ignition of gas-generating material, that is to say for inflating air bags. In order to achieve the desired effect, $BKNO_3$ is applied over a large surface distributed along the entire gas generator; in addition, plates forming chambers coated

in the same manner are provided. This is achieved by dipping the corresponding mechanical parts in an aqueous $BKNO_3$ solution, with a subsequent drying procedure. This type of gas generator is ignited by a conventional thermo-electric igniter. This construction is relatively complicated and voluminous and produces only an improved flaming distribution to a gas generator which has already ignited.

In the course of further technical developments of air bags and pyrotechnically activated belt tensioning means, it has been found that the known systems cause pressure pulses on ignition, and these have a negative effect on gas propagation and have an adverse influence on the desired gentle inflation of the air bag, or cause mechanical overloads. The same thing also occurs in the case of pyrotechnic belt tensioning means, where the pump plunger is acted upon too quickly.

It is thus the object of the present invention to eliminate the disadvantages of the known art and to provide a gas generator igniting capsule of the type mentioned at the outset which adequately increases the triggering and operational reliability of air bags and pyrotechnic belt tensioning means and prevents a

compressed gas generation which is dangerous, undesired and/or excessively harsh and thus also hazardous to the system.

The subject of the invention should be capable of integration in apparatus known per se for increasing the safety of vehicle and/or aircraft passengers.

The structural elements forming the apparatus should be capable of integration in the igniter easily and without positioning aids. Sensitive insulating layers, insulating adhesives and the like which are inter alia also unfavourable to mass production should be eliminated.

The object is achieved by the features of Claim 1.

The arrangement of the electrically conductive parts ensures that any voltage surge is diverted to an earth line and is thus made harmless. At the same time, the arrangement of at least two different detonators enables the igniting chain to be matched to the detonation rate which is favourable to the engineering of the system in the region of the priming. In practice, the use of two detonators in the igniter primarily brings about

reliable ignition of the first detonator layer and then propagation of the ignition at a reduced igniting rate in the second, less highly explosive detonator layer. As a result of the two detonator layers being pressed together, surprisingly the desired priming effect is also produced in the less highly explosive detonator.

The embodiment of the invention in accordance with Claim 2 is conveniently used only if powerful pressure pulses cannot cause damage in relation to use of the apparatus.

Claim 3 discloses a variant in which it is primarily the gentle inflation of the air bag which is important and there is no risk of spurious electrical pulses.

A further variant in accordance with Claim 4 is particularly suitable for igniters encapsulated in metal.

Subsequent dependent claims disclose advantageous further developments of the subject of the invention.

Preferably, the galvanically conductive ring is constructed to have sharp edges (Claim 5) so that any sparkover takes place at a site defined by the partially increased field strength.

The combination of the galvanically conductive ring with a seal in accordance with Claim 6 is particularly convenient, since it reduces the structural height of the igniter and is moreover economical.

It is recommended, in accordance with Claim 7, to construct the bore of the ring to be frustoconical, so that an electrical field which is increased towards the sharp edge is produced here.

The embodiment in accordance with Claim 8 represents a further development so that an optimum field line concentration can be achieved.

The mechanical integration of the contact pins, in accordance with Claim 9, into the plug socket reduces the necessary dimensions and at the same time provides the possibility of very good axial guidance of the pin.

The embodiment in accordance with Claim 10 is particularly convenient for the galvanically conductive rings which are laid in the die casting mould before injection of the synthetic material.

Instead of a peripheral contact, in accordance with

Claim 11 the galvanically conductive ring can be placed on a flange of the metal igniter housing so that the structural height of the igniter is additionally reduced.

A galvanically conductive ring which projects by means of contact faces out of a housing made of synthetic material and is contacted by an also galvanically conductive gas generator housing is particularly economically favourable (Claim 12).

The incorporation of the propagation charge or at least of components of the propagation charge as provided in the gas generator in accordance with Claim 13 has proved useful.

$BKNO_3$, in accordance with Claim 14, in pressed form has proved extremely favourable as the second detonator.

Lead trizinate, in accordance with Claim 15, gives the necessary reliability for ignition, even in combination with further detonators which are not highly explosive.

It is useful to choose the ratios of the two detonator layers in accordance with the figures according to Claim 16, since on the one hand the necessary pressure

build-up is ensured and on the other hand pressure surges are avoided.

In addition, the mixing ratio of $BKNO_3$ can be adapted to a desired optimum pressure curve and optimized in accordance with the figures given in Claim 17.

Preferred particle sizes of the lead trizinate in accordance with Claim 18 give improved functional reliability.

The controlled selection of the particle sizes or crystals of the $BKNO_3$ mixture, in accordance with Claim 19, also serve to improve the quality of the ignition procedure.

Preferably, the detonator layers are pressed into a synthetic cap (Claim 20) and encapsulate it, which is useful for reasons of reaction chemistry and corrosion technology.

The use of a glow wire, in accordance with Claim 21, has proved very useful in conjunction with the use of two detonator layers; moreover, it can be produced very economically.

Embodiments of the subject of the invention will be described in more detail below with reference to drawings, in which:

Fig. 1a shows a sectional illustration of an igniter which is encapsulated in gas-tight manner and has an integrated voltage surge diverter,

Fig. 1b shows the igniter from Fig. 1a, viewed from above,

Fig. 2 shows part of a voltage surge diverter which is developed further than Fig. 1a,

Fig. 3 shows a partially sectional illustration of a low-cost igniter with a metal housing,

Fig. 4 shows part of the voltage surge diverter from Fig. 3,

Fig. 5 shows a further partially sectional illustration of an igniter which is largely made from synthetic material,

Fig. 6 shows part of the voltage surge diverter from Fig. 5,

Fig. 7 shows a variant, comprising an igniter having a synthetic housing,

Fig. 8 shows the galvanically conductive ring inserted in the housing in Fig. 7,

Fig. 9 shows the plan view from below of the igniter from Fig. 7, without charge cap and with the contact faces of the conductive ring projecting,

Fig. 10 shows a gas generator having an igniting chain according to the invention,

Fig. 11 shows an enlarged sectional illustration of the gas generator of Fig. 10, with details of the construction of the igniter, and

Fig. 12 shows the characteristic pressure curve resulting from an igniter according to the invention at different temperatures.

In Fig. 1a, 1 designates a glow wire igniter. In a housing 2 which is galvanically connected to earth E and is made of an aluminium alloy known per se, there are notches 3 on the end side which represent predetermined

break points for the igniter and out of which the hot gas which is formed after the electrical ignition can pass over into the gas generator (not illustrated here) or can ignite the igniting layer thereof.

In a fitting ring 4 laid in the housing 2 there is an insulator 10 made of glass, in which contact pins 8 are cast concentrically. The two contact pins 8 are ground to be planar with the end side of the insulator 10; over this there is welded a glow wire which serves as the igniting element 7.

On the igniting means 7 there is a first priming layer 5 against which a second priming layer 6 bears. Both igniting layers 5 and 6 are pressed at relatively high pressure so that they form a compact unit.

The two contact pins 8, having a diameter d, are guided in a plug socket 9a and are protected and can be joined by lateral plug safety closures 9.

A galvanically conductive ring 12, which is inserted with form fit in the bore of the housing 2, in turn surrounds the contact pins 8 concentrically with its own bore 12a and, at the portion following the bent portion,

forms a spacing ê with respect to these contact pins in a correspondingly short region. The structural height of this ring 12 is at least twice the diameter d of the contact pins and is designated D.

Additionally, an annular groove 14 is provided in the lower end of the ring 12, cf. Fig. 2, and an O ring 13 is inserted in this annular groove 14, which effects secure sealing of the ring 12 with respect to the metal housing, when inserted so as to fit therein.

The arrangement, which is constructed above to be very compact, is joined together in mechanically fixed and gas-tight manner by a flanged portion 2a.

The contact pins 8 extend through the bore of the ring 12 so as to be orthogonal to the igniting element 7 and parallel to the axis of the ring. They extend parallel and close to the wall of the ring bore 12a, and are guided or located laterally to define the spacing between the contact pins and the ring 12.

The spacing between the ring bore 12a and the contact pins is determined, with reference to the breakdown field strength, to act as a surge diverter for voltage

surges on the contact pins, diverting such surges to the earth ring 12 and to the earth connection E.

Seen from above, the shape of the contact pins 8 with the plug socket 9a and the plug fuse 9 can be seen from Fig. 1b. In addition, an air gap is formed by the cutout 11 in the plug socket 9a and through which the blast of the voltage surge can pass to the outside air can be seen.

The galvanically conductive ring 15 according to Fig. 2 is constructed in a similar manner to that in Fig. 1a, but in this case it is possible to see the frustoconical construction of the bore 16, which ends at the sharp edge 16a provided in Fig. 2, similarly to Fig. 1a, and which produces a high field strength in the event of any voltage surges.

In relation to the voltage surge behaviour, this embodiment is more favourable than a purely axially symmetrical bore.

The variant of Fig. 3 is constructed in a similar manner to the igniter according to Fig. 1a, but in this case an insulator 10a of synthetic material which projects into a charge cap 4′, also of synthetic material, is provided.

Furthermore, the galvanically conductive ring, designated ring 17, is of small structural height and lies on an inner rim of a metal housing 2′ by means of a contact face 20. The plug socket 9a, which is constructed as a synthetic die cast part, engages in apertures 19 and fixes the arrangement radially symmetrically and is inserted in an insulating flange 9b.

The plug socket 9a surrounds the contact pins 8 so that an interior space formed by the cutout 11′ is protected from environmental influences. Once again, the spacing ê is matched to the predetermined or provided disruptive field strength.

The structural shaping of the conductive ring 17 with its bore 18 and the apertures 19 can be seen from Fig. 4.

The igniter according to Fig. 5 is structured in a similar manner, but in this case a conductive ring 21 which has a prismatic sharp peripheral inner edge 22′ in its bore 22 is provided.

This embodiment has the advantage that it produces a toroidal electrical field whereof the maximum field strength lies in half the structural height of the ring

21 and is distributed symmetrically. For drawing reasons, the spacing ē is not illustrated here. The plan view, Fig. 6, again shows apertures 23 which take account of the shape of the plug socket 9a reaching through.

The housing 2" used here is also of metal; contact faces 24 of the ring 21 form the connection to the earth line.

In Fig. 7, a partial illustration of an igniter made of synthetic material can be seen. The housing part 2''', made of polyamide, contains a conductive ring 25 which is constructed in the manner of a cam wheel, (cf. Fig. 8), and contact faces 27, (Fig. 9), project out of the housing 2''' and serve to connect to the earth line E through the metal face of a gas generator (not illustrated). Once again, recesses 28 which serve to fix the ring 25 concentrically with its bore 26 are provided.

The plan view of Fig. 9 shows the two metal contact pins 8 arranged in the centre, planar with the insulator 10a made of synthetic material. The igniting element, comprising glow wire, like the detonator layers which are in a charge cap to be pushed over the insulator 10a,

Fig. 7, are not drawn in here.

The spacing provided for the structural variants which are indicated above between the minimum bore of the galvanically conductive rings and the diameter of the contact pins is in the order of magnitude of 0.5 mm.

The overvoltage protection described above (25 kV in accordance with German Standard VG 95378, Part 11) is thus ensured in a reproducible manner.

The materials used for constructing the igniter are known per se. Thus, the conductive ring is preferably made of stainless machining steel (Cr/Ni alloy); the glow wire is of an Ni/Cr alloy. The contact pins are preferably made from an Ni/Fe alloy and are gold-plated in their connection region. In particular, glass fibre-reinforced Polyamid 6.6 (trade mark of the company EMS Chemie AG, Domat-Ems) has proved useful as the synthetic material.

In Fig. 10, a pot-shaped gas generator is designated 100. It substantially comprises a combustion chamber housing 101, having chambers, baffles and filter elements which are not illustrated in more detail, and

has in the centre a cylindrical central pipe 102 in which a propagation charge 103 made of $BKNO_3$ is located. Passages 104 in the form of bores ensure that after ignition gas passes through into the combustion chamber 106, which is filled with pyrotechnic compositions 107 known per se, so-called pellets. The igniting signal is switched by way of an electrical plug 108 and a two-pin igniting cable 109 via sensors and is supplied to the arrangement, generated in known manner.

The igniter 1 is held in a manner centred axially symmetrically by a carrier flange 105 and by means of a bracket-shaped flange 105b. A securing collar 105a prevents axial displacement, and additionally a securing bush 110 serves for locking. Details of the construction of the igniter 1 in the propagation charge 103 can be seen from Fig. 11; in addition, the plug fuse 9 is indicated here.

The housing 2, a metal capsule produced by flanging, contains notches 3 on the end face which represent predetermined break points and ensure a controlled passage of gas over to the propagation charge 103. In the capsule 2 which is formed in this manner there is a charge cap 4 made of synthetic material, in which a

first detonator 5 and a second detonator 6 are pressed in under pressure. In the first detonator 5 there is a glow wire 7 which forms a resistance bridge between the two contact pins 8 and acts as an electrical igniting means.

The contact pins 8 are cast into an insulator 10 made of glass and flat at its end faces.

As can be seen from the illustration in accordance with Fig. 11, which is restricted to what is essential to the invention, the propagation charge 103 and the second detonator are of the same material, that is to say a mixture of boron potassium nitrate = $BKNO_3$. The first detonator layer 5 is made of lead trinitroresorcinate, also called trizinate.

As can be seen from Fig. 12, in a test capsule (test bomb) with a volume of 3 cm^3, there is established within approximately 1 ms a pressure of around 90 bar, which falls only very slowly during a further interval of 10 ms. With an ambient temperature of 85°C, a maximum pressure of 97 bar is built up within 1 ms to 2 ms, falls to 80 bar after 0.5 ms and is still 60 bar after approximately 10 ms. At 20°C, the maximum

pressure is 90 bar, after a further 0.5 ms approximately 80 bar, and after 7 ms sinks to approximately 70 bar.

The pressure regions which are not permissible for reasons of the engineering of the system are drawn as hatched areas in the graph according to Fig. 12.

The subject of the invention fulfils the requirement even at very low temperatures. At -35°C, a pressure of approximately 70 bar is built up within less than 2.0 ms, and is maintained for more than 10 ms.

This pressure curve in the gas generator having the igniter according to the invention is essential to reliable functioning of the impact protection system.

Detonator layers which have proved to be optimal are those having a mass of pressed first detonator of 30 mg of trizinate and, also pressed, 75 mg of boron potassium nitrate as the second detonator. Here, the ratio of boron to potassium nitrate is 40% by weight of B and 60% by weight of KNO_3.

Particle sizes of boron in the range of 50 m have proved successful.

By varying the quantities within the limits mentioned in the claims, the gas evolution on priming in the igniting chain can be controlled in such a way that it can largely be matched to the physical properties of an air bag or to its mechanical load capacity. Similarly, the pressure graph with belt tensioning means, together with the other system parameters of the gas generator, can be matched to the kinetic conditions of the plunger and the reeling-in mechanism.

To achieve a priming effect of the two detonator layers, it is necessary to press them in the capsule 2; pressing pressures of up to 10,000 N/cm^2 have proved convenient. Surprisingly, no incidence occurred even at considerably higher pressures.

It goes without saying that more than two detonator layers can also be present in the igniting capsule if the igniting chain is to be adapted to a gentle pressure build-up dependent on the system. Similarly, conventional detonators can also be used for matching to the desired pressure graph, generally the igniting chain beginning with the more highly explosive detonator and being propagated to the less highly explosive detonators.

List of reference numerals

1	Igniter (glow wire igniter)
2 - 2'''	Housing (capsule)
2a	Flanged portion of 2
3	Notches (predetermined break point)
4	Fitting ring; spacer ring
4'	Charge cap (synthetic material)
5	1st detonator
6	2nd detonator
7	Igniting element; glow wire
8	Contact pins
9	Plug fuse
9a	Plug socket
9b	Insulating flange
10	Insulator (glass)
10a	Insulator (synthetic material)
11, 11'	Cutout
12	Conductive ring
12a	Bore of 12
13	Rubber seal (O ring)
14	Annular groove
15	Conductive ring (variant I)
16	Conical bore
16a	Sharp edge
17	Conductive ring (variant II)
18	Bore
19	Apertures of 17
20	Contact face of 17
21	Conductive ring (variant III)
22	Bore of 21
22'	Sharp inner edge of 21 (prismatic)
23	Apertures of 21
24	Contact face of 21
25	Conductive ring (variant IV)
26	Bore
27	Contact face of 24
28	Cutouts

100	Gas generator (pot-shaped)
101	Combustion chamber housing
102	Central pipe
103	Propagation charge
104	Passages (bores)
105	Carrier flange
105a	Securing collar
105b	Bracket-shaped flange
106	Combustion chamber
107	Pyrotechnic compositions (pellets)
108	Electrical plug
109	Igniting cable (2-pin)
110	Securing bush
d	Diameter of 8
D	Thickness (height) of the ring 12
E	Earth line
G	Gas (filters)
$\hat{e}$	Disruptive field strength

Claims

1. A gas generator igniting capsule having an electrical igniter comprising detonator, the electrical igniter being provided with a contact bridge having a defined electrical resistance and at least one contact pin being attached to the contact bridge by means of a plug-type connection;

wherein the contact pin is directed towards the igniting element orthogonal to the latter through the concentric bore of a galvanically conductive ring;

this ring has a thickness which corresponds to at least twice the diameter of the contact pin and is connected to an earth line of the igniting apparatus;

the contact pin is at least partially spaced, with respect to an electrode formed by the bore of the ring, by a distance matched to the breakdown field strength, so that it forms the counter electrode in the event of a voltage surge occurring at the contact pin and diverts this voltage surge to an earth line;

at least two detonators are provided in the igniting capsule, the second being less highly explosive than the first detonator;

the first detonator surrounds the igniting means and is an organometallic detonator;

the second detonator is an inorganic mixture; and both detonators are pressed into layer form and encapsulated in a pressure-tight manner.

2. A gas generator igniting capsule having an electrical igniter and comprising detonator, the electrical igniter being provided with a contact bridge having a defined electrical resistance and at least one contact pin attached to the contact bridge by means of a plug-type connection; wherein the contact pin is directed towards the igniting element orthogonal to the latter and laterally guided through the concentric bore of a galvanically conductive ring; the ring has a thickness which corresponds to at least twice the diameter of the contact pin and is connected to the earth line of the igniting apparatus; and the contact pin is at least partially spaced, with respect to this electrode formed by the bore of the ring, by a distance matched to the breakdown field strength, so that it forms the counter electrode in the event of a voltage surge occurring at the contact pin and diverts this voltage surge to an earth line.

3. A gas generator igniting capsule having an electrical igniter and comprising detonator, the

igniting capsule being adapted to be at least partially embedded in a propagation charge of the gas generator; wherein at least two detonators are provided in the igniting capsule, the second being less highly explosive than the first detonator; the first detonator surrounds the igniting means and is an organometallic detonator; the second detonator is an inorganic mixture; and both detonators are pressed into layer form and encapsulated in pressure-tight manner.

4. A gas generator igniting capsule having an electrical igniter and comprising detonator, the electrical igniter being provided with a contact bridge having a defined electrical resistance and the igniting capsule being provided with two mutually spaced contact pins which project thereinto and with a predetermined break point in an end region; the contact pins being embedded by fusion in an insulating body which is made of glass and surrounded by a metal fitting ring, and being connected in end regions to the contact bridge; the fitting ring being enclosed in a gas-tight manner in the interior of the capsule; wherein a further ring having at least one concentric sharp inner edge is provided in a position axially displaced from the fitting ring surrounding the insulating body, this

further ring being connected to the earth line of the igniting apparatus and forming, by means of its sharp edge, one electrode of a spark gap; the contact pins being at least partially spaced by a distance matched to the provided disruptive field strength from this electrode, so that at least one of the two contact pins forms a counter electrode in the event of a voltage surge occurring and diverts this voltage surge to the earth line.

5. A gas generator igniting capsule according to Claim 1, characterized in that the bore of the ring is constructed to have a sharp edge.

6. A gas generator igniting capsule according to Claim 4, characterized in that the ring has an annular groove in which a sealing ring made of an elastomer is received.

7. A gas generator igniting capsule according to one of Claims 1, 4, 5, characterized in that the bore of the ring is constructed to be frustoconical.

8. A gas generator igniting capsule according to one of Claims 1, 4, 5, characterized in that the bore of the

ring contains a sharp edge formed by a prismatic bead.

9. A gas generator igniting capsule according to Claim 1 or 4, characterized in that a plug socket which laterally guides the contact pins is provided.

10. A gas generator igniting capsule according to Claim 1 or 4, characterized in that the plug socket passes through and fixes the ring.

11. A gas generator igniting capsule according to one of Claims 1, 4, 5, characterized in that the ring lies on a part of the metal housing and forms the galvanic connection to the earth line.

12. A gas generator igniting capsule according to Claim 1 or 4, characterized in that the ring comprises contact faces which project out of the housing and form the galvanic connection to the earth line.

13. A gas generator igniting capsule according to Claim 1, characterized in that the second detonator comprises at least two reactive components, and in that similar components are provided in the propagation charge of the gas generator.

14. A gas generator igniting capsule according to Claim 13, characterized in that the reactive components of the second detonator are boron and potassium nitrate.

15. A gas generator igniting capsule according to Claim 1, characterized in that the first detonator is lead trinitroresorcinate.

16. A gas generator igniting capsule according to Claim 1, characterized in that the ratio by weight of the first detonator to the second is 1:2 to 1:5.

17. A gas generator igniting capsule according to Claim 14, characterized in that the ratio of boron to potassium nitrate is 10 to 70% by weight of B and 30 to 90% by weight of KNO_3.

18. A gas generator igniting capsule according to Claim 15, characterized in that the lead trinitroresorcinate has a particle size from 80 µm to 120 µm.

19. A gas generator igniting capsule according to Claim 17, characterized in that the boron potassium nitrate has an average particle size from 40 µm to 70 µm.

20. A gas generator igniting capsule according to Claims 1 and 13 to 19, characterized in that the two detonators are encapsulated in pressed form in a synthetic cap.

21. A gas generator igniting capsule according to Claim 1, characterized in that the igniting means is a glow wire.

22. A gas generator substantially as hereinbefore described with reference to Figures 1 or 2, or 3 and 4, or 5 and 6, or 7 to 9 or 10 and 11 of the accompanying drawings.

Patents Act 1977 **Examiner's report to the Comptroller under Section 17** **(The Search report)** -30-	Application number GB 9416848.1
Relevant Technical Fields (i) UK Cl (Ed.M) F3A (ii) Int Cl (Ed.5) F42B; F42C	Search Examiner R C SQUIRE
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Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) -	Documents considered relevant following a search in respect of Claims :- 1, 2, 4 to 12, 21, 22

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Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 0862704	(DU PONT) see particularly page 2 lines 20 to 25	1, 2
X	EP 0269475 A	(S.E.P)	2
X	EP 0266052 A	(IRECO)	2
X	EP 0029671 A	(ICI)	1, 2
X	US 4271453	(T. YASIMA) see particularly column 3 line 54 to column 4 line 8	2

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